UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF CALIFORNIA

SAN DIEGO

APPLE INC., Plaintiff, vs. WI-LAN INC., Defendant.	CASE NO. 14cv2235 DMS (BLM) **DECLARATION OF KENNETH STANWOOD IN SUPPORT OF WI-LAN INC.'S REPLY IN SUPPORT OF ITS MOTION TO COMPEL** Department: 13A Judge: Hon. Dana M. Sabraw Magistrate Judge: Hon. Barbara L. Major

I, KENNETH STANWOOD, hereby declare as follows:

1. I am an inventor on U.S. Patent Nos. 8,457,145 (the "'145 patent"), 8,462,723 (the "'723 patent"), 8,537,757 (the "'757 patent"), 8,615,020 (the "'020 patent"), 8,462,761 (the "'761 patent"), and 8,311,040 (the "'040 patent") (collectively, the "patents-in-suit"). I was a principal drafter of the original Institute of Electrical and Electronic Engineers (IEEE) 802.16 WiMAX standard and served as Vice-Chair of the IEEE 802.16 committee during development of the 4G WiMAX (or Mobile WiMAX) standard.

2. I submit this Declaration in Support of Wi-LAN Inc.'s ("Wi-LAN") Reply in Support of its Motion to Compel Apple Inc. ("Apple") to produce certain discovery in the above-captioned action.

3. I have reviewed Apple's Opposition to Wi-LAN's Motion to Compel production of Mobile WiMAX related documents and the publicly-filed exhibits thereto.

4. If asked, I am prepared to testify before the Court regarding the content of this declaration.

I. BACKGROUND

5. I received a Bachelor of Science degree with highest honors in Mathematical Sciences from Oregon State University in 1983 and a Master of Science degree in Computer Science from Stanford University in 1987.

6. My co-inventors and I developed the technology in the patents-in-suit while working at Ensemble Communications ("Ensemble") in the late 1990s and early 2000s. My team was significantly involved in development of the WiMAX standards. I was a principal drafter of the original WiMAX Standard and served as Vice-Chair of the IEEE 802.16 committee during development of Mobile WiMAX. I have submitted thousands of comments on and made dozens of contributions to the original and Mobile WiMAX standards.

7. Having been active in the development of WiMAX, I know first-hand that our patented technology was adopted in IEEE 802.16-2001 standard and subsequent versions of IEEE 802.16, including the Mobile WiMAX standard that was released in 2005.

II. EVOLUTION OF WIMAX

8. Generally speaking, the WiMAX Standards provide wireless broadband access to consumers. While the original version was aimed at providing wireless broadband in "fixed" or stationary deployments (e.g., providing broadband access wirelessly to the workers in an office building), the standard evolved to support mobile deployments (e.g., cellular telephones).

9. IEEE published the first version of WiMAX in 2001, called the "IEEE 802.16-2001" standard. WiMAX continued to develop, and over the following years released amendments, such as IEEE 802.16a and IEEE 802.16c. Each amendment defined changes to the original IEEE 802.16-2001 standard, but did not re-publish parts of the standard that remained unchanged.

10. Periodically, for ease of reference, the IEEE republished the entire standard including all the amendments in a single document. This was known as a "revision" or a "roll-up."

11. In 2004, the IEEE published a "revision" called IEEE 802.16-2004, which "rolled-up" IEEE 802.16-2001 and the subsequent amendments into a single document.

12. In 2005, the IEEE published the IEEE 802.16e-2005 amendment to the IEEE 802.16-2004 standard, sometimes referred to as "Mobile" WiMAX, or 4G WiMAX. IEEE 802.16e-2005 was not an entirely new standard, but rather an amendment to the existing IEEE 802.16-2004 standard.

13. The IEEE continued to release amendments over the following years, and in 2009, again "rolled up" the previous revision and the subsequent amendments into a single document, the IEEE 802.16-2009 standard.

III. THE PATENTED TECHNOLOGIES ARE USED IN MOBILE WIMAX

14. My team contributed the inventions described in the patents-in-suit to the first version of WiMAX, IEEE 802.16-2001. For purposes of this declaration, I focus on three of the technologies at issue in this lawsuit: (1) bandwidth request and allocation (the '020 Patent), (2) packing and fragmenting ('040 Patent), and (3) multi-connection prioritization ('723 Patent and '761 Patent). These technologies were included in IEEE 802.16-2001 (the original WiMAX), IEEE 802.16-2004 (the WiMAX "roll-up"), IEEE 802.16e-2005 (the 4G Mobile WiMAX amendment), and IEEE 802.16-2009 (the 4G Mobile WiMAX "roll-up"). This means that each of the inventions, though originally developed as part of our work on WiMAX, was carried over into Mobile WiMAX and thus could be used in cellular phones using Mobile WiMAX (e.g., cellular phones on Sprint's WiMAX network).

15. The technologies of these patents-in-suit include the following:

- Bandwidth request and allocation technology, which enabled devices to request bandwidth upon demand, and to make their own decisions about how to most efficiently use that bandwidth across multiple connections ('020 patent);
- Packing and fragmenting technology, which enabled devices to more efficiently use the bandwidth granted to them by packing and fragmenting variable-length SDUs into variable-length PDUs ('040 patent); and
- Multi-connection prioritization technology, which enabled devices to utilize voice and high-speed data connections at the same time ('723 and '761 patents).

16. As shown below, all three of these technologies were first included in the original WiMAX and 4G Mobile WiMAX.

A. Bandwidth Request and Allocation

17. The bandwidth request and allocation technology my team contributed and patented was used by IEEE 802.16-2001, IEEE 802.16-2004, IEEE 802.16e-2005, and IEEE 802.16-2009.

18. For example, the following excerpts from IEEE 802.16-2001 shows that WiMAX adopted our proposal that enabled wireless devices to request bandwidth when they needed it and to allocate that bandwidth across their connections.

> **6.2.6 Bandwidth allocation and request mechanisms**
>
> Note that at registration every SS is assigned three dedicated CIDs for the purpose of sending and receiving control messages. Three connections are used to allow differentiated levels of QoS to be applied to the different connections carrying MAC management traffic. Increasing (or decreasing) bandwidth requirements is necessary for all services except incompressible constant bit rate UGS connections. The needs of incompressible UGS connections do not change between connection establishment and termination. The requirements of compressible UGS connections, such as channelized T1, may increase or decrease depending on traffic. Demand Assigned Multiple Access (DAMA) services are given resources on a demand assignment basis, as the need arises.
>
> When an SS needs to ask for bandwidth on a connection with BE scheduling service, it sends a message to the BS containing the immediate requirements of the DAMA connection. QoS for the connection was established at connection establishment and is looked up by the BS.
>
> There are numerous methods by which the SS can get the bandwidth request message to the BS.

6.2.6.1 Requests

Requests refer to the mechanism that SSs use to indicate to the BS that they need uplink bandwidth allocation. A Request may come as a stand-alone Bandwidth Request Header or it may come as a PiggyBack Request (see 6.2.2).

Because the uplink burst profile can change dynamically, all requests for bandwidth shall be made in terms of the number of bytes needed to carry the MAC header and payload, but not the PHY overhead. The Bandwidth Request Message may be transmitted during any of the following intervals:

Request IE
Any Data Grant Burst Type IE

IEEE 802.16-2001 at 85-86.

19. The following excerpts from IEEE 802.16-2004 shows that the 2004 version of WiMAX continued to enable wireless devices to request bandwidth when they needed it and to allocate that bandwidth across their connections.

6.3.6 Bandwidth allocation and request mechanisms

Note that during network entry and initialization every SS is assigned up to three dedicated CIDs for the purpose of sending and receiving control messages. These connection pairs are used to allow differentiated levels of QoS to be applied to the different connections carrying MAC management traffic. Increasing (or decreasing) bandwidth requirements is necessary for all services except incompressible constant bit rate UGS connections. The needs of incompressible UGS connections do not change between connection establishment and termination. The requirements of compressible UGS connections, such as channelized T1, may increase or decrease depending on traffic. Demand Assigned Multiple Access (DAMA) services are given resources on a demand assignment basis, as the need arises.

When an SS needs to ask for bandwidth on a connection with BE scheduling service, it sends a message to the BS containing the immediate requirements of the DAMA connection. QoS for the connection was established at connection establishment and is looked up by the BS.

There are numerous methods by which the SS can get the bandwidth request message to the BS. The methods are listed in 6.3.6.1 through 6.3.6.6.

6.3.6.1 Requests

Requests refer to the mechanism that SSs use to indicate to the BS that they need uplink bandwidth allocation. A Request may come as a stand-alone bandwidth request header or it may come as a PiggyBack Request (see 6.3.2.2.2). The capability of Piggyback Request is optional.

Because the uplink burst profile can change dynamically, all requests for bandwidth shall be made in terms of the number of bytes needed to carry the MAC header and payload, but not the PHY overhead. The Bandwidth Request message may be transmitted during any uplink allocation, except during any initial ranging interval.

IEEE 802.16-2004 at 141.

20. The following excerpt from IEEE 802.16e-2005 shows that the 4G Mobile WiMAX amendment did not remove the sections cited above, and thus continued to enable wireless devices to request bandwidth when they needed it and to allocate that bandwidth across their connections. Further, the 4G Mobile WiMAX amendment does not describe a different way for mobile deployments to schedule bandwidth. Thus, all WiMAX compliant devices, including those used in both fixed and mobile deployments, request and allocate bandwidth as described in these sections of the standard.

> **6.3.6 Bandwidth allocation and request mechanisms**
>
> **6.3.6.1 Requests**
>
> ***Change the second paragraph as indicated:***
>
> Because the uplink burst profile can change dynamically, all requests for bandwidth shall be made in terms of the number of bytes needed to carry the MAC header and payload, but not the PHY overhead. The Bandwidth Request message may be transmitted during any uplink allocation, except during any initial ranging interval. <u>An SS shall not request bandwidth for a connection if it has no PDU to transmit on that connection.</u>

IEEE 802.16e-2005 at 184.

21. The following excerpts from IEEE 802.16-2009 shows that the 2009 version of Mobile WiMAX continued to enable devices in fixed and mobile deployments to request bandwidth when they needed it and to allocate that bandwidth across their connections.

> **6.3.6 Bandwidth allocation and request mechanisms**
>
> Note that during network entry and initialization every SS is assigned up to three dedicated CIDs for the purpose of sending and receiving management messages. These connection pairs are used to allow differentiated levels of QoS to be applied to the different connections carrying MAC management traffic. Increasing (or decreasing) bandwidth requirements is necessary for all services except UGS connections. The needs of UGS connections do not change between connection establishment and termination.
>
> When an SS needs to ask for bandwidth on a connection with BE scheduling service, it sends a message to the BS containing the immediate requirements of the connection. QoS for the connection was established at the connection setup and is looked up by the BS.

6.3.6.1 Requests

Requests refer to the mechanism that SSs use to indicate to the BS that they need UL bandwidth allocation. A Request may come as a stand-alone BR header or it may come as a PiggyBack Request (e.g., Grant management subheader, see 6.3.2.2.2). The use of Grant management subheader is optional.

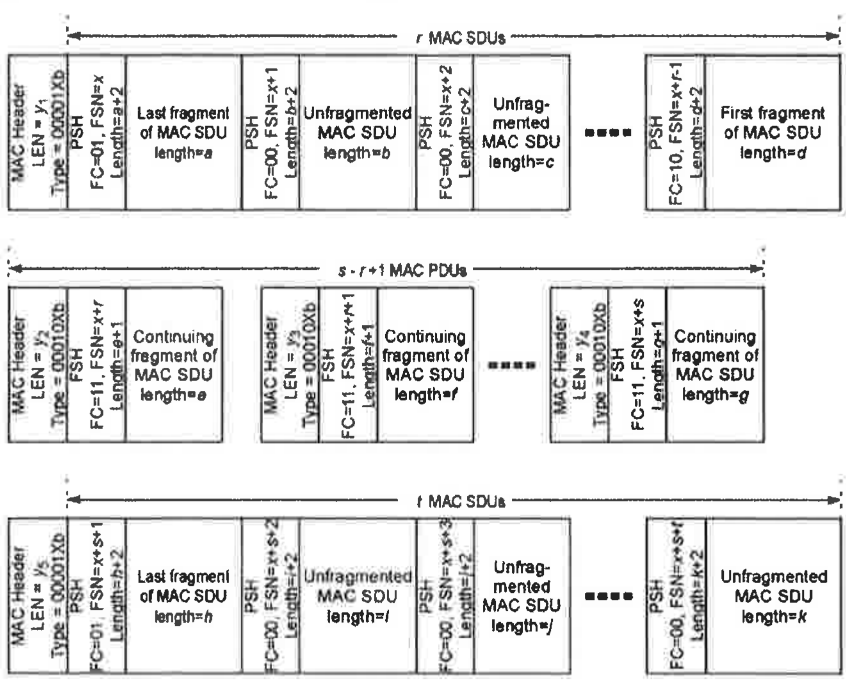
Because the UL burst profile can change dynamically, all requests for bandwidth shall be made in terms of the number of bytes needed to carry the MAC PDU excluding PHY overhead. The BR message may be transmitted during any UL allocation, except during any initial ranging interval. An SS shall not request bandwidth for a connection if it has no PDU to transmit on that connection.

IEEE 802.16-2009 at 295-96.

B. <u>Packing and Fragmenting Technology</u>

22. The packing and fragmenting technology my team contributed and patented was used by IEEE 802.16-2001, IEEE 802.16-2004, IEEE 802.16e-2005, and IEEE 802.16-2009.

23. For example, the following figure from IEEE 802.16-2001 shows that WiMAX adopted our proposal that enabled wireless devices to pack and fragment variable-length SDUs into variable-length PDUs.



Note: If Type=0x03, a GM subheader (not shown in figure) is also present immediately following the Generic MAC header.

Figure 30—Packing with fragmentation

IEEE 802.16-2001, Fig. 30.

24. The following figure from IEEE 802.16-2004 shows that the 2004 version of WiMAX continued to enable wireless devices to pack and fragment variable-length SDUs into variable-length PDUs.

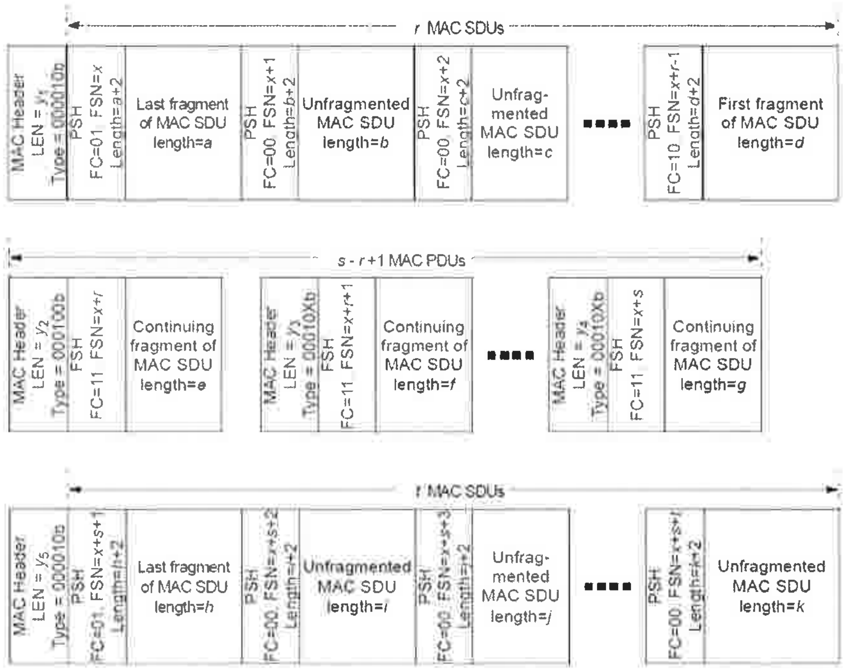


Figure 28—Packing with fragmentation

IEEE 802.16-2004, Fig. 28.

25. The figure above remains unchanged in IEEE 802.16e-2005, and thus Mobile WiMAX continued to enable mobile devices to pack and fragment variable-length SDUs into variable-length PDUs. Further, the 4G Mobile WiMAX amendment did not change the requirement that all devices fragment data. Thus, WiMAX compliant devices, including those used in both fixed and mobile deployments, pack and fragment variable-length SDUs into variable-length PDUs as depicted in this section of the standard.

26. The following figure from IEEE 802.16-2009 shows that the 2009 version of Mobile WiMAX continued to enable devices in fixed and mobile deployments to pack and fragment variable-length SDUs into variable-length PDUs.

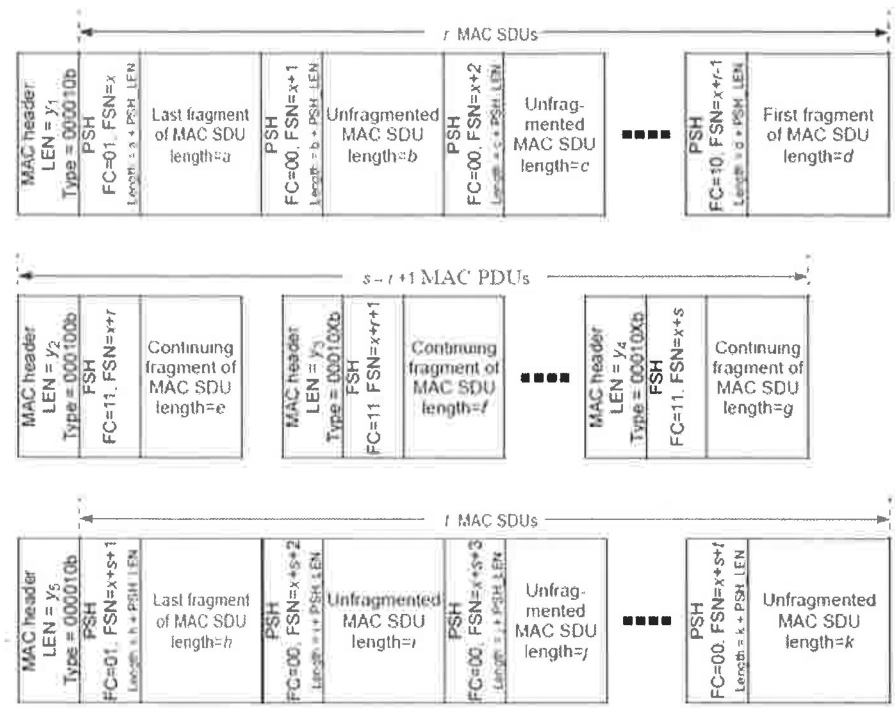


Figure 44—Packing with fragmentation

IEEE 802.16-2009, Fig. 44.

C. Multi-Connection Prioritization Technology

27. The multi-connection prioritization technology my team contributed and patented was used by IEEE 802.16-2001, IEEE 802.16-2004, IEEE 802.16e-2005, and IEEE 802.16-2009.

28. For example, the following excerpt from IEEE 802.16-2001 shows that WiMAX adopted our proposal that enabled wireless devices to manage varying levels of quality of service ("QoS") across multiple connections and enabled them to utilize voice and high-speed data connections at the same time.

> The MAC is connection-oriented. For the purposes of mapping to services on SSs and associating varying levels of QoS, all data communications are in the context of a connection. Service flows may be provisioned when an SS is installed in the system. Shortly after SS registration, connections are associated with these service flows (one connection per service flow) to provide a reference against which to request bandwidth. Additionally, new connections may be established when a customer's service needs change. A connection defines both the mapping between peer convergence processes that utilize the MAC and a service flow. The service flow defines the QoS parameters for the PDUs that are exchanged on the connection.
>
> The concept of a service flow on a connection is central to the operation of the MAC protocol. Service flows provide a mechanism for uplink and downlink QoS management. In particular, they are integral to the bandwidth allocation process. An SS requests uplink bandwidth on a per connection basis (implicitly identifying the service flow). Bandwidth is granted by the BS either as an aggregate of all grants for an SS (within a scheduling interval) or on a connection basis.

IEEE 802.16-2001 § 6.

29. The following excerpt from IEEE 802.16-2004 shows that the 2004 version of WiMAX continued to enable wireless devices to manage varying levels of QoS across multiple connections and utilize voice and high-speed data connections at the same time.

> The MAC is connection-oriented. For the purposes of mapping to services on SSs and associating varying levels of QoS, all data communications are in the context of a connection. Service flows may be provisioned when an SS is installed in the system. Shortly after SS registration, connections are associated with these service flows (one connection per service flow) to provide a reference against which to request bandwidth. Additionally, new connections may be established when a customer's service needs change. A connection defines both the mapping between peer convergence processes that utilize the MAC and a service flow. The service flow defines the QoS parameters for the PDUs that are exchanged on the connection.
>
> The concept of a service flow on a connection is central to the operation of the MAC protocol. Service flows provide a mechanism for uplink and downlink QoS management. In particular, they are integral to the bandwidth allocation process. An SS requests uplink bandwidth on a per connection basis (implicitly identifying the service flow). Bandwidth is granted by the BS to an SS as an aggregate of grants in response to per connection requests from the SS.

IEEE 802.16-2004 § 6.1.

30. The following excerpt from IEEE 802.16e-2005 shows that the Mobile WiMAX amendment did not remove the section cited above, and thus continued to enable mobile devices to manage varying levels of QoS across multiple connections and utilize voice and high-speed data connections at the same time. Further, IEEE

802.16e-2005 does not prescribe a different method for mobile devices to prioritize voice and data. Thus, WiMAX compliant devices, including those used in both fixed and mobile deployments, use our multi-connection prioritization technology when prioritizing voice and data.

> The MAC is connection-oriented. For the purposes of mapping to services on SSs and associating varying levels of QoS, all data communications are in the context of a transport connection. Service flows may be provisioned when an SS is installed in the system. Shortly after SS registration, transport connections are associated with these service flows (one connection per service flow) to provide a reference against which to request bandwidth. Additionally, new transport connections may be established when a customer's service needs change. A transport connection defines both the mapping between peer convergence processes that utilize the MAC and a service flow. The service flow defines the QoS parameters for the PDUs that are exchanged on the connection.
>
> The concept of a service flow on a transport connection is central to the operation of the MAC protocol. Service flows provide a mechanism for uplink and downlink QoS management. In particular, they are integral to the bandwidth allocation process. An SS requests uplink bandwidth on a per connection basis (implicitly identifying the service flow). Bandwidth is granted by the BS to an SS as an aggregate of grants in response to per connection requests from the SS.

IEEE 802.16-e2005 § 6.1.

31. The following excerpt from IEEE 802.16-2009 shows that the 2009 version of Mobile WiMAX continued to enable devices in fixed and mobile deployments to manage varying levels of QoS across multiple connections and utilize voice and high-speed data connections at the same time.

> The MAC is connection-oriented. For the purposes of mapping to services on SSs and associating varying levels of QoS, all data communications are in the context of a transport connection. Service flows may be provisioned when an SS is installed in the system. Shortly after SS registration, transport connections are associated with these service flows (one connection per service flow) to provide a reference against which to request bandwidth. Additionally, new transport connections may be established when a customer's service needs change. A transport connection defines both the mapping between peer convergence processes that utilize the MAC and a service flow. The service flow defines the QoS parameters for the PDUs that are exchanged on the connection.
>
> The concept of a service flow on a transport connection is central to the operation of the MAC protocol. Service flows provide a mechanism for UL and DL QoS management. In particular, they are integral to the bandwidth allocation process. An SS requests UL bandwidth on a per-connection basis (implicitly identifying the service flow). Bandwidth is granted by the BS to an SS as an aggregate of grants in response to per-connection requests from the SS.

IEEE 802.16-2009 § 6.1.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on November 1, 2017 in Carlsbad, California.

Kenneth Stanwood